CLAIMS

I claim:

1. A cooling apparatus for a laser system comprising:

a single circulating unit having a tank for holding a supply of cooling fluid, and a pumping device operative for circulating said cooling fluid through a laser source, a laser power supply, a light valve and back into the circulating unit;

wherein a flow of said cooling fluid is divided into first and second parallel supply branches, said laser source connected in series with said first supply branch, and wherein said light valve and said laser power supply are connected in series with said second supply branch; and

wherein the flow of said cooling fluid in said second parallel supply branch passes through the laser power supply after the flow of said cooling fluid has passed through said light valve.

2. The cooling apparatus of claim 1 wherein said circulating unit further includes a refrigeration unit operative to cool said cooling fluid below normal room temperature.

3. The cooling apparatus of claim 1 further comprising a flow rate sensor connected in series to a coolant outlet port of said laser source, said flow rate sensor operative to provide a signal to a controller, said signal representative of a flow rate of cooling fluid passing through said laser source.

4. The cooling apparatus of claim 3 wherein said controller shuts down said power supply when said signal falls below a predetermined value indicating said flow rate of cooling fluid has decreased below a desired flow rate.

5. The cooling apparatus of claim 1 further comprising a flow control valve connected in series to a coolant inlet portion of said light valve, said flow control valve operable to maintain a constant flow rate of said cooling fluid through said second parallel branch.

6. The cooling apparatus of claim 5 wherein a first flow rate of said cooling fluid in said first parallel branch is about 0.13 gallon per minute and a second flow rate of said cooling fluid in said second parallel branch is about 0.5 gallon per minute.

7. The cooling apparatus of claim 1 wherein said power supply contains thermal monitoring and shutdown apparatus.

8. The cooling apparatus of claim 1 wherein a shut off valve is serially connected between a coolant outlet port of said laser power supply and a coolant return port of said circulating unit, said valve operative to reversibly interrupt said flow of said cooling fluid.

9. A cooling apparatus for a laser system comprising:

a single circulating unit having a tank for holding a supply of cooling fluid, and a pumping device operative for circulating said cooling fluid through a laser, a flow rate sensor, a flow control valve, a laser light valve, a laser power supply, and back into the circulating unit;

a first supply branch connected to a coolant supply port deposed on said circulating unit, said first supply branch providing a first flow of cooling fluid at a first flow rate, to a first coolant inlet port of a laser, said first flow of cooling fluid exiting a first coolant outlet port of said laser after passing through a portion of said laser, said first flow of cooling fluid then passing through a flow rate sensor serially connected to said first outlet port of said laser, said first flow of cooling fluid then returning back to said circulating unit; and

a second supply branch connected to said coolant supply port deposed on said circulating unit in parallel to said first supply branch, said second supply branch providing a second flow of cooling fluid at a second flow rate different than said first flow rate, first to said flow control valve, then to said laser light valve serially connected to said flow control valve, and lastly to said laser power supply serially connected to said laser light valve, said second flow of cooling fluid then returning back to said circulating unit.

10. The cooling apparatus of claim 9 wherein said circulating unit further includes a refrigeration unit operative to cool said cooling fluid below normal room temperature.

11. The cooling apparatus of claim 9 wherein said flow rate sensor is operative to provide a signal to a controller, said signal representative of a flow rate of cooling fluid passing through said laser.

12. The cooling apparatus of claim 11 wherein said controller shuts down said laser power supply when said signal falls below a predetermined value indicating said flow rate of cooling fluid has decreased below a desired flow rate.

13. The cooling apparatus of claim 9 further wherein said flow control valve is operable to maintain a constant flow rate of said cooling fluid through said second parallel branch.

14. The cooling apparatus of claim 9 wherein said first flow rate of said cooling fluid in said first parallel branch is about 0.13 gallon per minute and said second flow rate of said cooling fluid in said second parallel branch is about 0.5 gallon per minute.

15. The cooling apparatus of claim 9 wherein said laser power supply further includes thermal monitoring and shutdown apparatus.

16. The cooling apparatus of claim 9 wherein a valve is serially connected between a coolant outlet port of said laser power supply and a coolant return port of said circulating unit, said valve operative to reversibly interrupt said flow of said cooling fluid.

17. A cooling apparatus for a laser system comprising:

a laser source for producing a laser beam;

a laser power supply operative to provide electrical power to said laser source;

a light valve for producing a plurality of individual light beams from said laser beam and for independently modulating each of said plurality of light beams;

a single refrigeration unit having a tank for holding a supply of cooling fluid, and a pumping device operative for circulating said cooling fluid through said laser source, said laser power supply, said light valve and back into the refrigeration unit;

wherein a flow of said cooling fluid is divided into first and second parallel supply branches, said laser source connected in series with said first branch, and wherein said light valve and said laser power supply are connected in series with said second branch; and

wherein the flow of said cooling fluid in said second parallel branch passes through the laser power supply after the flow of said cooling fluid has passed through said light valve.

18. The cooling apparatus of claim 17 further comprising a flow rate sensor connected in series to a coolant return portion of said laser source, said flow rate sensor operative to provide a signal to a controller, said signal representative of a flow rate of cooling fluid passing through said laser source.

19. The cooling apparatus of claim 17 wherein said controller shuts down said laser power supply when said signal falls below a predetermined value indicating said flow rate of cooling fluid has decreased below a desired flow rate.

20. The cooling apparatus of claim 17 further comprising a flow control valve connected in series to a coolant inlet portion of said light valve, said flow control valve operable to maintain a constant flow rate of said cooling fluid through said second parallel branch.

21. The cooling apparatus of claim 17 wherein a first flow rate of said cooling fluid in said first parallel branch is about 0.13 gallon per minute and a second flow rate of said cooling fluid in said second parallel branch is about 0.5 gallon per minute.

22. The cooling apparatus of claim 17 wherein said laser power supply contains thermal monitoring and shutdown apparatus.

23. The cooling apparatus of claim 17 wherein a valve is serially connected between said laser power supply and said circulating unit, said valve operative to reversibly interrupt said flow of said cooling fluid.

24. A method of cooling a laser system, said laser system comprising a laser source, a laser light valve and a laser power supply, the method comprising the steps of:

providing a single circulating unit having a tank for holding a supply of cooling fluid, and a pumping device operative for circulating said cooling fluid through said laser source, a flow rate sensor, a flow control valve, said laser light valve, said laser power supply, and back into the circulating unit;

providing a first parallel flow path by serially connecting said laser source and said flow rate sensor together, and connecting a coolant inlet port deposed on said laser source to a coolant supply port of said circulating unit, and further connecting a coolant outlet port of said flow rate sensor to a coolant return port deposed on said circulating unit;

providing a second parallel flow path by connecting said coolant supply port of said circulating unit to a first port of said flow control valve, and serially connecting a second port of said flow control valve to a first port of said laser light valve, and serially connecting a second port of said laser light valve to a coolant input port of said laser power supply, and then connecting a coolant outlet port of said laser power supply to said coolant return port deposed on said circulating unit;

establishing flow of cooling fluid through each of first and second parallel flow paths wherein a first flow rate of cooling fluid through said first parallel path is different than a second flow rate of cooling fluid through said second parallel path;

wherein said first rate of cooling fluid flow is determined by a size and number of cooling channels formed in a portion of said laser; and

wherein said second rate of cooling fluid flow is controlled by said flow control valve, said flow control valve further operative to maintain said second rate of cooling fluid flow constant.

25. The method of cooling a laser system of claim 24 wherein said circulating unit further includes the step of cooling said cooling fluid below normal room temperature prior to circulating said fluid into said first and said second parallel flow paths.

26. The method of cooling a laser system of claim 24 further including the step of disabling said laser power supply in response to an error signal exceeding a predetermined value, said error signal generated by said flow rate sensor, said error signal monitored by a controller.